deeply furrowed in a plane parallel to the axis of rotation, so as to be shaped like a dumb-bell, and although this result can only be taken to represent the truth very roughly, yet it cannot be entirely explained by the imperfection of the analytical method employed. It appears then as if the smaller body were on the point of separating into two masses, in the same sort of way that the Jacobian ellipsoid may be traced through the dumb-bell shape until it becomes two masses.

M. Poincaré has commented in his paper on the possibility of the application of his results, so as to throw light on the genesis of a satellite according to the nebular hypothesis, and this investigation was undertaken with such an expectation. He remarks, however, that the conditions for the separation from a mass, which is strongly concentrated at its centre, are necessarily very different from those which he has treated mathematically.

However, both his investigation and the considerations adduced here seem to show that, when a portion of the central body becomes detached through increasing angular velocity, the portion should bear a far larger ratio to the remainder than is observed in our satellites, as compared with their planets; and it is hardly probable that the heterogeneity of the central body can make so great a difference in the results as would be necessary, if we are to make an application of these ideas.

It seems then at present necessary to suppose that after the birth of a satellite, if it takes place at all in this way, a series of changes occur which are still quite unknown.

VII. "The Influence of Stress and Strain on the Physical Properties of Matter. Part I. Elasticity—*continued*. The Velocity of Sound in Metals, and a Comparison of their Moduli of Torsional and Longitudinal Elasticities as determined by Statical and Kinetical Methods." By HERBERT TOMLINSON, B.A. Communicated by Professor W. GRYLLS ADAMS, M.A., F.R.S. Received April 29, 1887.

(Abstract.)

The principal object of the investigation was to ascertain whether the values of the moduli of torsional and longitudinal elasticities, as determined by statical methods, would be the same as when determined by kinetical methods, provided the deformations produced were very small.

The method of determining the modulus of longitudinal elasticity statically has been already described.* This method was applied with

* 'Phil. Trans.,' 1883, Part I.

the greatest care to wires of piano-steel, copper, platinum-silver, silver, and platinum. The wires of copper, silver, and platinum were obtained from Messrs. Johnson and Matthey as chemically pure.

The same wires were also tested for the value of the modulus of longitudinal elasticity by the method of longitudinal vibrations. In this method the wires were fixed at both ends, and corrections, which are fully described in the paper, were made for the want of rigidity in the supports at the ends. The same method served for determining the velocity of sound in the metals piano-steel, iron, copper, German-silver, platinum-silver, silver, and platinum, with considerable accuracy. The following two tables give the results obtained :—

Table I.

Metal.	Condition.	Density.	Velocity of sound in metres per second.
Piano-steel	Unannealed.......	7·7475	5198
Iron.............	Annealed	7·6831	5096
Copper	Unannealed.......	8·8976	3958
German-silver	"	8·6320	3860
Platinum-silver ...	"	12·1900	2804
Silver............	"	10·4668	2801
Platinum.........	"	21·0500	2750

Table II.

Metal.	Condition.	Young's modulus in grams per sq. cm. as obtained by the kinetical method. e_k.	Ditto, as obtained by the statical method. e_s.	$\frac{e_k}{e_s}$.
Piano-steel ...	Unannealed.	2133×10^6	2140×10^6	0·997
Copper	" .	1316	1323	0·995
Platinum.....	" .	1622	1623	1·000
Platinum-silver	" .	997	1001	0·996
Silver	" .	835·6	828·6	1·008
			Mean........	0·999

Four of the wires used in the experiments on longitudinal elasticity were also tested for torsional elasticity, both by the method of statical torsion, and by the method of torsional vibrations. The diameter of each of the wires was about 1 mm., and the lengths varied from 650 to 800 cm., thus even with very small torsional defor-

mations, considerable accuracy was attainable. The results of these last experiments are given in Table III.

Table III.

Metal.	Condition.	Modulus of torsional elasticity in grams per sq. cm. obtained by the statical method. r_s.	Ditto, obtained by the kinetical method. r_k.	$\frac{r_k}{r_s}$.
Iron	Annealed...	$751 \cdot 5 \times 10^6$	$766 \cdot 5 \times 10^6$	1·020
Platinum.....	Unannealed.	662·2	663·5	1·002
Silver........	"	275·5	278·0	1·009
Aluminium ..	"	267·7	266·9	0·997

The general results of the whole investigation may be expressed as follows:—

1. The value of the modulus of longitudinal elasticity for hard-drawn metals, as determined by the statical method of loading, accords with the value obtained by the method of longitudinal vibrations, provided the deformations are sufficiently small.

2. The velocity of sound in a metal wire is independent of the load on the wire.

3. The velocity of sound in a metal wire is not sensibly altered by permanent extension of the wire.

4. The value of the modulus of torsional elasticity, as determined by the statical method, accords with the value obtained by the method of torsional vibrations for most metals in the hard-drawn condition, provided the deformations produced are small. For annealed iron the value of the modulus obtained by the second method slightly exceeds that obtained by the first method, and by an amount which is greater than can be attributed either to the heating and cooling effects of contraction and expansion, or to errors of observation.